ISO Rules
Part 500 Facilities
Division 502 Technical Requirements
Section 502.8 SCADA Technical and Operating Requirements

Applicability

1 Section 502.8 applies to:

(a) the **legal owner** of a **generating unit**:

(i) connected to the **transmission facilities** in the **balancing authority area** of the **ISO**;

(ii) connected to the **electric distribution system** or multiple **generating units** connected to the same metering point on the **electric distribution system** where the output of such **generating unit** or **multiple generating units** is greater than or equal to five (5) MW measured at the metering point on the **electric distribution system**;

(iii) that is part of a power plant connected to **transmission facilities** in the **balancing authority area** of the **ISO**;

(iv) that is part of an industrial complex connected to the **transmission system**; or

(v) providing, or part of a facility providing, **ancillary services**;

(b) the **legal owner** of an **aggregated generating facility**;

(i) connected to **transmission facilities** in the **balancing authority area** of the **ISO**; or

(ii) providing **ancillary services**;

(c) the **legal owner** of a **transmission facility** connected to the **transmission system**;

(d) the **legal owner** of a load:

(i) connected to the **transmission system**;

(ii) that is part of an industrial complex; or

(iii) providing **ancillary services**; and

(e) the **ISO**.

Requirements

Facility with Functional Specifications Issued On or After February 28, 2013

2 The **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility, legal owner** of a **transmission facility** or **legal owner** of a load who is a **legal owner** of a **generating unit**, an **aggregated generating facility**, a **transmission facility** or a load for which the **ISO** issues a functional specification on or after February 28, 2013, must design and construct its facilities in accordance with the minimum supervisory control and data acquisition requirements of this section 502.8 and verify to the **ISO** that the facility meets those requirements during **commissioning** and energization of the new facility.

Functional Specifications, Technical Requirements and Standards Issued Prior to February 28, 2013

3(1) Subject to subsection 3(2), the provisions of this section 502.8 do not apply to a facility:

(a) that was built in accordance with a technical requirement or technical standard; or

(b) with a functional specification;

the **ISO** issued prior to February 28, 2013, but the facility must remain in compliance with that technical requirement, technical standard or functional specification including all of the standards and requirements set out in that technical requirement, technical standard or functional specification.

(2) Notwithstanding subsection 3(1), the **ISO** may require the **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility, legal owner** of a **transmission facility** and **legal owner** of a load, any of which have an existing facility, to comply with any specific or all of the provisions of this section 502.8, if the **ISO** determines that such compliance is necessary for the safe and reliable operation of the **interconnected electric system**.

(3) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility, legal owner** of a **transmission facility** and **legal owner** of a load must comply with the provisions of this section 502.8 if:

(a) it is modifying its facilities to:

(i) increase its Rate DTS or Rate STS contract capacity; or

(ii) upgrade or alter the functionality of its supervisory control and data acquisition system; and

(b) the **ISO** determines that the modification is necessary for safe and reliable operation of the **interconnected electric system**.

Functional Specification

4(1) The **ISO** must, in accordance and generally consistent with this section 502.8 and any other applicable **ISO rules**, approve of a functional specification containing further details, work requirements and specifications for the design, construction and operation of a supervisory control and data acquisition system for the facility.

(2) The functional specification referred to in subsection 4(1) must be generally consistent with the provisions of this section 502.8 but may contain material variances the **ISO** approves of based upon its discrete analysis of any one (1) or more of the technical, economic, safety, operational and **reliability** requirements related to the specific system or connection project.

Supervisory Control and Data Acquisition Requirements

5(1) The **legal owner** of a **generating unit** must meet the supervisory control and data acquisition requirements set out in Appendix 1, *SCADA Requirements for Generating Units*.

(2) The **legal owner** of a wind **aggregated generating facility** must meet the supervisory control and data acquisition requirements set out in Appendix 2, *SCADA Requirements for Wind Aggregated Generating Facilities*.

(3) The **legal owner** of a **generating unit** that is part of an industrial complex and **the legal owner** of a load must meet the supervisory control and data acquisition requirements set out in Appendix 3, *SCADA Requirements for Industrial Complexes and Load*.

(4) The **legal owner** of a **transmission facility** must meet the supervisory control and data acquisition requirements set out in Appendix 4, *SCADA Requirements for Transmission Facilities*, if at least one (1) of the following criteria is met:

(a) the substation contains two (2) or more buses operated above sixty (60) kV nominal voltage;

(b) the substation contains one (1) or more buses operated above two hundred (200) kV nominal voltage;

(c) the substation contains a capacitor bank, reactor, static VAr compensator or synchronous condenser rated five (5) MVAr or greater;

(d) the substation connects three (3) or more transmission lines above sixty (60) kV;

(e) the substation supplies local site load, with normally energized site load equipment rated at five (5) MVA or greater that are offered for **ancillary services** or are included in **remedial action schemes**;

(f) the substation supplies local site load with normally energized site load equipment rated at ten (10) MVA or greater;

(g) the substation supplies **supplemental reserve** load of five (5) MVA or greater; or

(h) the substation supplies system load that is part of a **remedial action scheme**.

(5) The **legal owner** of a **generating unit**, the **legal owner** of an **aggregated generating facility** and the **legal owner** of a load must, if they provide **ancillary services**, meet the supervisory control and data acquisition requirements for substations set out in Appendix 5, *SCADA Requirements for Ancillary Services*.

(6) The **ISO** must meet the supervisory control and data acquisition requirements set out in:

(i) Appendix 2, *SCADA Requirements for Wind Aggregated Generating Facilities*; and

(ii) for substations, Appendix 5, *SCADA Requirements for Ancillary Services*, as it applies to substations.

Dual Meters

6 A **legal owner** of a **generating unit**, the **legal owner** of an **aggregated generating facility**, the **legal owner** of a **transmission facility** and the **legal owner** of a load must gather supervisory control and data acquisition data using a device that is independent from a revenue meter.

Data Acquisition

7(1) The **ISO** must initiate all supervisory control and data acquisition communications with a **legal owner**'s equipment directly connected to the **ISO**'s equipment to acquire supervisory control and data acquisition data from a **legal owner** and must do so using the following means:

(a) periodic scans; or

(b) report-by-exception polls.

(2) The **ISO** must configure the **ISO**'s communications device to be the "master" device.

(3) The **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must configure its communication device to be the "slave" device using the appropriate addressing the **ISO** assigns.

(4) The **ISO** must, if it initiates communications with a **legal owner** using report-by-exception polls, configure and acquire the supervisory control and data acquisition data so that the data value falls within the allowable deadbands set out in Table 1 below:

Table 1

Value	Allowable Deadband
MW	0.5 MW from 0 to 200MW, 1.0 MW above 200 MW
MVAR	0.5 MVAR from 0 to 200MVAR, 1.0 MVAR above 200 MVAR
kV	0.1 kV from 0 to 20kV, 0.5 kV above 20 kV

(5) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must, if they are providing analog values to the **ISO**, provide those values with at least one (1) decimal place accuracy unless otherwise specified in the attached appendices.

(6) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must ensure that the transducer is scaled such that the maximum, full scale, value returned is between one hundred and twenty percent (120%) and two hundred percent (200%) of the nominal equipment rating.

(7) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load using a transducer must ensure that the transducer is scaled to a maximum, full scale of one hundred and twenty percent (120%) of the nominal equipment rating.

(8) A **legal owner** of a **generating unit** that uses a mode of operation of either a synchronous condenser or motor, must ensure that the minimum, full scale, values are between one hundred and twenty percent (120%) and two hundred percent (200%) of the lowest operating condition.

(9) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must report supervisory control and data acquisition data relating to power flows with the sign convention of positive power flow being out from a bus, except for those situations where source measurements are positive polarity.

(10) Notwithstanding subsection 7(9), a **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must report:

(a) MVAR measurements from a reactor as negative polarity;

(b) MW and MVAR measurements from a wind farm feeder bus as positive polarity; and

(c) MVAR measurements from a capacitor as positive polarity.

(11) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must, if installing a global positioning system clock as required in a functional specification, use the coordinated universal time as the base time where the base time is the universal time code minus seven (7) hours.

(12) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of **a load** must ensure that its global positioning system clock functionality provides for one (1) millisecond time stamped event accuracy and can automatically adjust for seasonal changes to daylight savings time.

Supervisory Control and Data Acquisition Communications

8(1) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must implement one (1) of the following communication methods between its facility and the **ISO**:

(a) an internet connection , if the **legal owner** has a latency time requirement of thirty (30) seconds or greater; or

(b) a dedicated telecommunications link, if the **legal owner** has a latency time requirement of less than thirty (30) seconds.

(2) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must provide and maintain a connectivity point and data communication to both the **ISO**'s primary system coordination centre and the **ISO**'s backup system coordination centre.

(3) The **ISO** must provide and maintain a connectivity point to the **legal owner**'s facility at both the **ISO**'s primary system coordination centre and the **ISO**'s backup system coordination centres.

(4) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility** and **legal owner** of a load must, if it owns a facility with the capability of combined load and generation greater than one thousand (1000) MW, provide two (2) communication circuits to each of the **ISO**'s primary system coordination centre and the **ISO**'s backup system coordination centre and to each of the **legal owner**'s primary and backup communication centres.

(5) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility** and **legal owner** of a load must, if they are providing **ancillary services**, send supervisory control and data acquisition data to each of the **ISO**'s primary system coordination centre and the **ISO**'s backup system coordination centre.

(6) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must, based on the **ISO**'s generic communication block diagrams and prior to connecting facilities to the **interconnected electric system**, indicate to the **ISO** the generic communication block diagram that depicts the communication protocols between the **legal owner**'s facility and the **ISO**'s system coordination centre, with any variations as

appropriate.

(7) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must, if it changes its communication protocols used between itself and the **ISO**, communicate these changes to the **ISO** in writing ninety (90) **business days** prior to changing the protocols.

Notification of Unplanned Availability

9(1) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must, if any component in the communication circuit becomes unavailable due to an unplanned event, notify the **ISO** as soon as reasonably practicable after determining such unavailability due to equipment failure.

(2) The **ISO** may, following receipt of the notification in 9(1), require the **legal owner** to discontinue the provision of **ancillary services**.

(3) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must provide the **ISO** with:

(a) the cause of any unavailability reported pursuant to section 9(1);

(b) in the event of an equipment failure, a plan, acceptable to the **ISO**, to repair the failed equipment, including testing; and

(c) the expected date when the equipment will be repaired and the required measurements will be restored.

(4) The **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must, if the equipment is not repaired and required measurements are not restored by the expected date, notify the **ISO** with the revised date and the reason why the communication system was not repaired.

(5) The **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must notify the **ISO** once the equipment is repaired and the required measurements are restored.

Suspected Failure or Erroneous Data of a Remote Terminal Unit

10(1) A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must, if it suspects that a remote terminal unit has failed or is providing erroneous data, notify the **ISO** immediately after identifying the failure or data error.

(2) The **ISO** must, if it suspects that a remote terminal unit has failed or is providing erroneous data, notify the **legal owner** immediately, after identifying the failure or data error.

(3) The **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must provide the **ISO** with the date it expects to test the remote terminal unit.

(4) The **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must, if it is unable to test the remote terminal unit on the expected date provided under subsection 10(3), provide the **ISO** with the revised date.

(5) The **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must, after testing the remote terminal unit, confirm if there is a problem with the remote terminal unit or not and notify the **ISO** with the results of the test.

(6) The **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must, if the results of the test indicated that the remote terminal unit has actually failed, provide the **ISO** with the date that the **legal owner** expects to repair or replace the remote terminal unit.

(7) The **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must, if the remote terminal unit is not repaired or replaced by the date provided under subsection 10(6), notify the **ISO** with the revised date.

(8) The **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load must notify the **ISO** once the remote terminal is repaired or replaced.

Compliance Exceptions

11 A **legal owner** of a **generating unit**, **legal owner** of an **aggregated generating facility**, **legal owner** of a **transmission facility** and **legal owner** of a load is not required to comply with the supervisory control and data acquisition data acquisition and submission requirements of this section 502.8 if:

(a) any device used in the acquisition and submission of the supervisory control and data acquisition data is being repaired or replaced; and

(b) the **legal owner** is using reasonable efforts to complete such repair or replacement in accordance with a plan, acceptable to the **ISO**, to address the unavailability, repair or replacement of the failed device.

Appendices

Appendix 1 – *SCADA Requirements for Generating Units*

Appendix 2 - *SCADA Requirements for Wind Aggregated Generating Facilities*

Appendix 3 - *SCADA Requirements for Industrial Complexes and Load*

Appendix 4 - *SCADA Requirements for Transmission Facilities*

Appendix 5 - *SCADA Requirements for Ancillary Services*

Revision History

Date	Description
2013-02-28	Initial Release
2014-12-23	Appendix 1 amended by combining the two lines concerning generating unit automatic voltage regulation into one line. Appendix 5 amended reflect that the regulating reserve set point signal is sent by ISO every 4 seconds, not every 2 seconds. Appendix 5 amended to include the measurement point for load when providing spinning reserve.
2015-03-27	Replaced “effective date” with the initial release date in sections 2 and 3; and replaced the word “Effective” in the Revision History to “Date”.

Appendix 1 – SCADA Requirements for Generating Units

Facility/ Service Description	Signal Type	Point Description	Parameter		Accuracy Level	Resolution	Latency and Availability Requirements Based on Maximum Authorized Real Power					
							Maximum authorized real power less than 50 MW		Maximum authorized real power equal to or greater than 50 MW and less than 300 MW		Maximum authorized real power equal to or greater than 300 MW	
							Latency	Availability (%)	Latency	Availability (%)	Latency	Availability (%)
For each power plant	Status	Communications failure alarm from remote terminal unit acting as a data concentrator for one or more generating units to a transmission facility control centre (if applicable)	0 = Normal	1= Alarm	N/A		30 seconds	98.0% mean time to repair is 48 hours	15 seconds	98.0% mean time to repair is 48 hours	4 seconds	99.8% mean time to repair is 4 hours
		Communications failure indication between an intelligent electronic device and any remote terminal unit acting as a data concentrator	0 = Normal	1= Alarm								
For each generating unit directly connected to the transmission system	Analog	Gross real power as measured at the stator winding terminal	MW		+/- 2% of full scale	0.5% of the point being monitored	30 seconds	98.0% mean time to repair is 48 hours	15 seconds	98.0% mean time repair is to 48 hours	4 seconds	99.8% mean time to repair is 4 hours
		Gross reactive power as measured at the stator winding terminal	MVAR									
		Generating unit voltage at the generator stator winding terminal or equivalent bus voltage	kV									
		Unit frequency as measured at the stator winding terminal or equivalent bus frequency	Hertz		+/- 0.012 Hz	0.001 Hz						
		Net real power as measured on the high side terminal of the transmission system step up transformer	MW		+/- 2% of full scale	0.5% of the point being monitored						
		Net real power of summated generation of a facility with multiple generating units offering as a single market participant	MW									
		Net reactive power as measured on the high side terminal of the transmission system step up transformer	MVAR									
		Net reactive power of summated generation of a facility with multiple generating units offering as a single market participant	MVAR									
		Unit service load measured on the high side of the unit service transformer if the capacity is greater than 0.5 MW	MW									
		Unit service load measured on the high side of the unit service transformer if the capacity is greater than 0.5 MW	MVAR									
		Station service load real power if the capacity is greater than 0.5 MW, or if the station service load is for multiple units then the combined load for those units, measured on the high side of the station service transformer	MW									
		Station service load reactive power if the capacity is greater than 0.5 MW, or if the station service load is for multiple units then the combined load for those units, measured on the high side of the station service transformer	MVAR									
		Excitation system real power if the capacity is greater than 0.5 MW, measured on the high side of the excitation system transformer	MW									
		Excitation system reactive power if the capacity is greater than 0.5 MW, measured on the high side of the excitation system transformer	MVAR									
		Voltage at the point of connection to the transmission system	kV									
		Automatic voltage regulation setpoint	kV									

		Transmission system step-up transformer tap position if the step up transformer has a load tap changer	Tap position		Integer Value	1					
		Ambient temperature if the generating unit is a gas turbine generating unit (range of minus 50 degrees to plus 50 degrees Celsius)	degrees Celsius		+/- 2% of full scale	1 degree					
	Status	Breaker, circuit switchers, motor operated switches and other devices that can remotely or automatically control the connection to the AIES; and does not include manually operated air breaks.	0 = Open	1= Closed	N/A		30 seconds	98.0% mean time to repair is 48 hours	15 seconds	98.0% mean time to repair is 48 hours	4 seconds	99.8% mean time to repair is 4 hours
		Transmission system step up transformer voltage regulator if the transmission system step up transformer has a load tap changer	0 = Manual	1= Auto								
		Generating unit power system stabilizer (PSS) status	0 = Off	1 = On								
		Generating unit automatic voltage regulation (AVR) in service and controlling voltage	0 = Off	1 = On								
		Remedial action scheme armed status, if applicable	0 = Disarmed	1= Armed			latency is 15 seconds availability is 98% mean time to repair is 48 hours				4 seconds	99.8% mean time to repair is 4 hours
		Remedial action scheme operated status on communications failure, if applicable	0 = Normal	1 = Alarm								
		Remedial action scheme operated status on runback, if applicable	0 = Normal	1 = Alarm								
		Remedial action scheme operated status on trip, if applicable	0 = Normal	1 = Alarm								
For each distribution connected generating unit, or multiple aggregate generating units, where the total turbine nameplate rating is greater than or equal to 5 MW	Analog	Gross real power as measured at the stator winding terminal	MW		+/- 2% of full scale	0.5% of the point being monitored	Latency is 30 seconds; Availability is 98%; Mean time to repair is 48 hours					
		Gross reactive power as measured at the stator winding terminal	MVAR									
		Generating unit voltage at the generator stator winding terminal or equivalent bus voltage	kV									
	Status	Breaker, circuit switchers, motor operated air brakes and other devices that can remotely control the connection to the AIES; and does not include manually operated air breaks.	0 = Open	1= Closed	N/A							

Appendix 2 – SCADA Requirements for Wind Aggregated Generating Facilities

Facility / Service Description	Signal Type	Point Description	Parameter	Accuracy Level	Resolution	Latency and Availability Requirements Based on Maximum Authorized Real Power					
						Maximum authorized real power less than 50 MW		Maximum authorized real power equal to or greater than 50 MW and less than 300 MW		Maximum authorized real power equal to or greater than 300 MW	
						Latency	Availability (%)	Latency	Availability (%)	Latency	Availability (%)
For each wind aggregated generating facility connected to the transmission system	Analog	Real power of each collector system feeder	MW	+/- 2% of full scale	0.5% of the point being monitored	30 seconds	98.0% mean time to repair is 48 hours	15 seconds	98.0% mean time to repair is 48 hours	4 seconds	99.8% mean time to repair is 4 hours
		Reactive power of each collector system feeder	MVAR								
		Voltage for each collector bus	kV								
		Real power of station service over 0.5 MW	MW								
		Reactive power of station service over 0.5 MW	MVAR								
		Reactive power of each reactive power resource (other than wind turbine generators)	MVAR								
		Real power at the low side of transmission system step up transformer	MW								
		Reactive power at the low side of transmission system step up transformer	MVAR								
		Transmission system step-up transformer tap position if the step up transformer has a load tap changer	Tap position	Integer Value	1						
		Net real power at the point of connection	MW	+/- 2% of full scale	0.5% of the point being monitored						
		Net reactive power at the point of connection	MVAR								
		Frequency at the point of connection	Hertz	+/- 0.012 Hz	0.001 Hz						
		Voltage at the point of connection	kV	+/- 2% of full scale	0.5% of the point being monitored						
		Voltage regulation system set point	kV								
		Potential real power capability, being the real power that would have been produced at the point of connection without wind aggregated generating facilities curtailment and based on real time meteorological conditions at each available wind turbine generator	MW	+/-10% of full scale							
		Real power limit used in the power limiting control system at the wind aggregated generating facilities	MW	+/- 2% of full scale							
		Wind speed at hub height as collected at the meterological tower	Meters per second	+/- 2% of anemometer maximum							
		Wind direction from the true north as collected at the meterological tower	Degrees	+/- 5 degrees	1 degree						
		(FROM ISO) Facility wind limit	MW	N/A	0.1 MW	Signal sent by ISO					
		(FROM ISO) Reason for facility wind limit	1 = Transmission, 2= Ramp, 3 = No limit	N/A		Signal sent by ISO					

	Status	Communications failure alarm from remote terminal unit acting as a data concentrator for one or more generating units to a transmission facility control centre (if applicable)	0 = Normal	1= Alarm	N/A		30 seconds	98.0% mean time to repair is 48 hours	15 seconds	98.0% mean time to repair is 48 hours	4 seconds	99.8% mean time to repair is 4 hours
		Communications failure indication between an intelligent electronic device and any remote terminal unit acting as a data concentrator	0 = Normal	1= Alarm								
		Each collector system feeder breaker	0 = Open	1 = Closed								
		Each reactive resource feeder breaker	0 = Open	1 = Closed								
		Wind power limiting control system	0 = Off	1 = On								
		Voltage regulation system status	0 = Manual	1 = Automatic								
		Breaker, circuit switchers, motor operated switches and other devices that can remotely or automatically control the connection to the AIES; and does not include manually operated air breaks.	0 = Open	1 = Closed								
		Generating unit step up transformer voltage regulator if the transmission system step up transformer has a load tap changer	0 = Manual	1 = Automatic								
		Remedial action scheme armed status, if applicable	0 = Disarmed	1= Armed								
		Remedial action scheme operated status on communications failure, if applicable	0 = Normal	1 = Alarm								
		Remedial action scheme operated status on runback, if applicable	0 = Normal	1 = Alarm								
		Remedial action scheme operated status on trip, if applicable	0 = Normal	1 = Alarm								
For each distribution connected generating unit, or multiple aggregate generating units, where the total turbine nameplate rating is greater than or equal to 5 MW	Analog	Gross real power as measured at the collector bus	MW		+/- 2% of full scale	0.5% of the point being monitored	latency is 30 seconds availability is 98% mean time to repair is 48 hours					
		Gross reactive power as measured at the collector bus	MVAR									
		Generating unit voltage at the collector bus	kV									
	Status	Breaker, circuit switchers, motor operated switches and other devices that can remotely or automatically control the connection to the AIES; and does not include manually operated air breaks.	0 = Open	1= Closed	N/A							

Appendix 3 – SCADA Requirements for Industrial Complexes and Load

Facility / Service Description	Signal Type	Point Description	Parameter		Accuracy Level	Resolution	Latency and Availability Requirements Based on Maximum Authorized Real Power					
							Maximum authorized real power less than 50 MW		Maximum authorized real power equal to or greater than 50 MW and less than 300 MW		Maximum authorized real power equal to or greater than 300 MW	
							Latency	Availability (%)	Latency	Availability (%)	Latency	Availability (%)
For each facility	Status	Communications failure alarm from remote terminal unit acting as a data concentrator for one or more generating units to a transmission facility control centre (if applicable)	0 = Normal	1= Alarm	N/A		30 seconds	98.0% mean time to repair is 48 hours	15 seconds	98.0% mean time to repair is 48 hours	4 seconds	99.8% mean time to repair is 4 hours
		Communications failure indication between an intelligent electronic device and any remote terminal unit acting as a data concentrator	0 = Normal	1= Alarm								
For each load facility or industrial complex	Analog	Real power at the point of connection	MW		+/- 2% of full scale	0.5% of the point being monitored	30 seconds	98.0% mean time to repair is 48 hours	15 seconds	98.0% mean time to repair is 48 hours	4 seconds	99.8% mean time to repair is 4 hours
		Reactive power at the point of connection	MVAR									
		Voltage at the point of connection	kV									
	Status	Breaker, circuit switchers, motor operated switches and other devices that can remotely or automatically control the connection to the AIES; and does not include manually operated air breaks.	0 = Open	1 = Closed	N/A							
A market participant with a remedial action scheme on its load facility or industrial complex	Analog	Total remedial action scheme load available	MW		+/- 2% of full scale	0.5% of the point being monitored	30 seconds	99.8% mean time to repair is 4 hours	15 seconds	99.8% mean time to repair is 4 hours	4 seconds	99.8% mean time to repair is 4 hours
		Amount of load armed	MW									
	Status	Remedial action scheme circuit breaker, circuit switcher or other controllable isolating devices	0 = Open	1 = Closed	N/A							
		Arming status of the remedial action scheme	0 = Disarmed	1 = Armed								
		Remedial action scheme operated status on communications failure, if applicable	0 = Normal	1 = Alarm								
		Remedial action scheme operated status on runback, if applicable	0 = Normal	1 = Alarm								
		Remedial action scheme operated status on trip, if applicable	0 = Normal	1 = Alarm								

Appendix 4 – SCADA Requirements for Transmission Facilities

Facility / Service Description	Signal Type	Point Description	Parameter		Accuracy Level	Resolution	Latency and Availability Requirements Based on Transmission Voltage			
							Any one bus operated at 60 kV or above, but less than or equal to 200 kV		Any one bus operated above 200 kV	
							Latency	Availability (%)	Latency	Availability (%)
For each substation	Status	Communications failure alarm from remote terminal unit acting as a data concentrator for one or more generating units to a transmission facility control centre (if applicable)	0 = Normal	1= Alarm	N/A		30 seconds	98.0% mean time to repair is 48 hours	15 seconds	98.0% mean time to repair is 48 hours
		Communications failure indication between an intelligent electronic device and each remote terminal unit acting as a data concentrator	0 = Normal	1= Alarm						
Bus	Analog	Bus voltage line-to-line. Ring or split busses require a minimum of two voltage sources	kV		+/- 2% of full scale	0.5% of the point being monitored	30 seconds	98.0% mean time to repair is 48 hours	15 seconds	98.0% mean time to repair is 48 hours
	Status	Breakers, circuit switchers, motor operated switches, or other remotely or automatically controllable isolating device status	0 = Open	1= Closed	N/A					
Transformer winding greater than 60 kV	Analog	Real power as measured on the high side terminal of the transformer	MW		+/- 2% of full scale	0.5% of the point being monitored	30 seconds	98.0% mean time to repair is 48 hours	15 seconds	98.0% mean time to repair is 48 hours
		Reactive power as measured on the high side terminal of the transformer	MVAR							
		Transformer voltage regulation setpoint if the transformer has a load tap changer	kV							
		Transformer tap position if the step up transformer has a load tap changer	Tap position		Integer Value	1				
	Status	Load tap changer	0 = Manual	1 = Automatic	N/A					
Reactive Resources	Analog	Reactive power of switchable reactive power resource - capacitor bank (positive polarity) or reactor (negative polarity)	MVAR		+/- 2% of full scale	0.5% of the point being monitored	latency is 30 seconds; availability is 98%; mean time to repair is 48 hours			
		Reactive power of dynamic reactive power resource - SVC, synchronous condenser, or other similar device					latency is 15 seconds; availability is 98%; mean time to repair is 48 hours			
		Voltage setpoint of dynamic reactive power resource - SVC, synchronous condenser, or other similar device	kV				latency is 15 seconds; availability is 98%; mean time to repair is 48 hours			
	Status	Reactive power resource control device - capacitor bank or reactor	0 = Off	1 = On	N/A		latency is 30 seconds; availability is 98%; mean time to repair is 48 hours			
		Reactive power resource control device - SVC, synchronous condenser, or other similar device	0 = Off	1 = On			latency is 15 seconds; availability is 98%; mean time to repair is 48 hours			
		Automatic voltage regulation status for dynamic reactive power resource - SVC, synchronous condenser, or other similar device	0 = Off	1 = On			latency is 15 seconds; availability is 98%; mean time to repair is 48 hours			
Remedial Action Scheme	Status	Remedial action scheme circuit breaker, circuit switcher or other controllable isolating devices	0 = Open	1 = Closed	N/A		30 Seconds	99.8% mean time to repair is 4 hours	latency is 15 seconds availability is 99.8% mean time to repair is 4 hours	
		Remedial action scheme armed status, if applicable	0 = Disarmed	1= Armed						
		Remedial action scheme operated status on communications failure, if applicable	0 = Normal	1 = Alarm						
		Remedial action scheme operated on equipment overload, if applicable	0 = Normal	1 = Alarm						
		Remedial action scheme operated status on trip, if applicable	0 = Normal	1 = Alarm						
Transmission line where the nominal	Analog	Real power	MW		+/- 2% of full scale	0.5% of the point being monitored	30 seconds	98% mean time to repair is 48 hours	N/A	
		Reactive power	MVAR							

voltage is greater than or equal to 60 kV and less than 200 kV	Status	Breakers, circuit switchers, motor operated switches, or other remotely or automatically controllable isolating device status	0 = Open	1= Closed	N/A					
Transmission line where the nominal voltage is equal to or greater than 200 kV	Analog	Real power	MW		+/- 2% of full scale	0.5% of the point being monitored	N/A		15 seconds	98% mean time to repair is 48 hours
		Reactive power	MVAR							
		Line side voltage	kV							
	Status	Breakers, circuit switchers, motor operated switches, or other remotely or automatically controllable isolating device status	0 = Open	1= Closed	N/A					

Appendix 5 – SCADA Requirements for Ancillary Services

Facility / Service Description	Signal Type	Point Description	Parameter		Accuracy Level	Resolution	Latency and Availability Requirements Based on Maximum Authorized Real Power					
							Maximum authorized real power less than 50 MW		Maximum authorized real power equal to or greater than 50 MW and less than 300 MW		Maximum authorized real power equal to or greater than 300 MW	
							Latency	Availability (%)	Latency	Availability (%)	Latency	Availability (%)
For each resource providing black start services	Analog	Bus frequency in hertz with a range of at least 57 to 63Hz	Hertz		+/- 0.012 Hz	0.001 Hz	30 seconds	98.0% mean time to repair is 48 hours	15 seconds	98.0% mean time to repair is 48 hours	4 seconds	99.8% mean time to repair is 4 hours
For each resource providing regulating reserves	Analog	Gross real power as measured at the stator winding terminal	MW		0.25% of full scale	0.25% of the point being monitored	latency is 2 seconds availability is 99.8% mean time to repair is 4 hours					
		Net real power as measured on the high side terminal of the step up transformer	MW									
		Gross real power set point from the regulating reserve resource control system	MW									
		High limit of the regulation range	MW				latency is 10 seconds availability is 99.8% mean time to repair is 4 hours					
		Low limit of the regulation range	MW									
		(FROM ISO) Set point. Note if multiple resources are used to provide the full resource commitment, the AESO will send a totalized expected MW output signal.	MW		N/A	0.1 MW	Signal sent by ISO every 4 seconds					
	Status	Regulating reserve resource circuit breaker status (required for all circuit breakers composing the resource)	0 = Open	1= Closed	N/A		latency is 2 seconds availability is 99.8% mean time to repair is 4 hours					
		Regulating reserve resource control status	0 = Disabled	1= Enabled								
		(FROM ISO) ISO has control of the regulating reserve resource	0 = Disarmed	1= Armed	N/A		Signal sent by AESO when regulating reserves are in effect (on or off)					
For each resource providing spinning reserves	Analog	Gross real power as measured at: a) For generating pool assets, the stator winding terminal or b) For load pool assets the closest circuit breaker or disconnection device to each load.	MW		+/- 2% of full scale	0.5% of the point being monitored	latency is 10 seconds availability is 99.8%, mean time to repair is 4 hours					
	Status	Spinning reserve resource circuit breaker status (required for all circuit breakers composing the resource)	0 = Open	1= Closed	N/A							
For each resource providing supplemental reserves either load or generation	Analog	Gross real power	MW		+/- 2% of full scale	0.5% of the point being monitored	30 seconds	98.0% mean time to repair is 48 hours	15 seconds	98.0% mean time to repair is 48 hours	4 seconds	99.8% mean time to repair is 4 hours
	Status	Supplemental reserve resource circuit breaker status (required for all circuit breakers composing the resource)	0 = Open	1= Closed	N/A							
For each	Analog	Actual Volume, being the real power consumed at the point of connection	MW		+/- 2% of	0.5% of the point	30 seconds	98.0%	15 seconds	98.0%	N/A	

resource providing load shed service for imports		Offered Volume, being the participant's real power offer to the ISO	MW		dispatched signal	being monitored		mean time to repair is 48 hours		mean time to repair is 48 hours		
		Armed Volume, being the real power commitment of the LSSI resource	MW									
		(From ISO) dispatched volume	MW		N/A		Signal sent by AESO when LSSI dispatched on or off					
	Status	LSSI provider status indication	0 = Disarmed	1 = Armed	N/A		30 seconds	98.0% mean time to repair is 48 hours	15 seconds	98.0% mean time to repair is 48 hours		
		(From ISO) load shed service for imports dispatch status	0 = Disarmed	1 = Armed	N/A		Signal sent by ISO when the load shed service for imports is dispatched on or off					